

STRUCTURE OF THIS MICROCARD (BASIC INSTRUCTIONS)

A02 = How to use this microcard	1	2	3	4
A01 = Structure of microcard			SIS	
B01 = Trouble-shooting chart	A-***X*	X*XXX	XXXXX	XXXXX *XXXX X
	B-*XXXX	XXXXX	XXXXX	XXXXX XXX
	C-XXXXX	XXXXX	XXXXX	XXXXX XXX
	D-XXXXX	XXXXX	XXXXX	XXXXX XXX
	E-XXXXX	XXXXX	XXXXX	XXXXX XX
	F-XXXXX	XXXXX	XXXXX	XXX
	G-XXXXX	XXXXX	XXXX	
	H-			
	J-			
	K-			
	L-			
	M-			
N01 = Service information	N-*XXXX	XXXXX	XXXXX XXX	*X XX*
	12345	67890	12345 67890	12345 678
		1	2	
			Index	
N28 = Table of contents and publication information				

- 1 = Special features
2 = Safety and precautionary measures
3 = Testers and tools
4 = Installation position of components

- a. Read from left to right.
b. Title of micropicture (appears on each micropicture).

E16	Product/component/test step	
	Coordinate	
c. Limits of section		
	Beginning	Mid-section
	End	One-page section
A01		=> <=

HOW TO USE THIS MICROCARD

Trouble-shooting instructions for system:
Electronic ignition

Descriptions, photos, terminal designations and special features refer to following vehicle:
FORD Escort 1,6 l
1,6 l / 4-cylinder engine EU 04.88->

These basic instructions represent detailed trouble-shooting instructions. They are not to be used as vehicle-specific instructions.

Important!
Descriptions and photos may differ from the vehicle-specific brief instructions.

Binding set values, terminal assignments and special features are to be taken exclusively from the vehicle-specific brief instructions.
For brief instructions refer to Contents Microcard KFZ-00..

A02		=> <=
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SPECIAL FEATURES

- * Control unit without knock control, however with self-diagnosis for temperature sensor and load sensor.
- * Flashing-code evaluation with evaluation unit KDAW 9980.

- * Solenoid valve for idle compensation.

If the idle speed drops below a certain value (e.g. due to alternator loading), the solenoid valve opens (actuated by the EI control unit) and opens up the air bypass. The engine speed is increased by approx. 100 min⁻¹ by the air which then bypasses the throttle valve.

The idle compensation only starts to come into operation when a speed of 750 min⁻¹ is dropped below.

SAFETY AND PRECAUTIONARY MEASURES

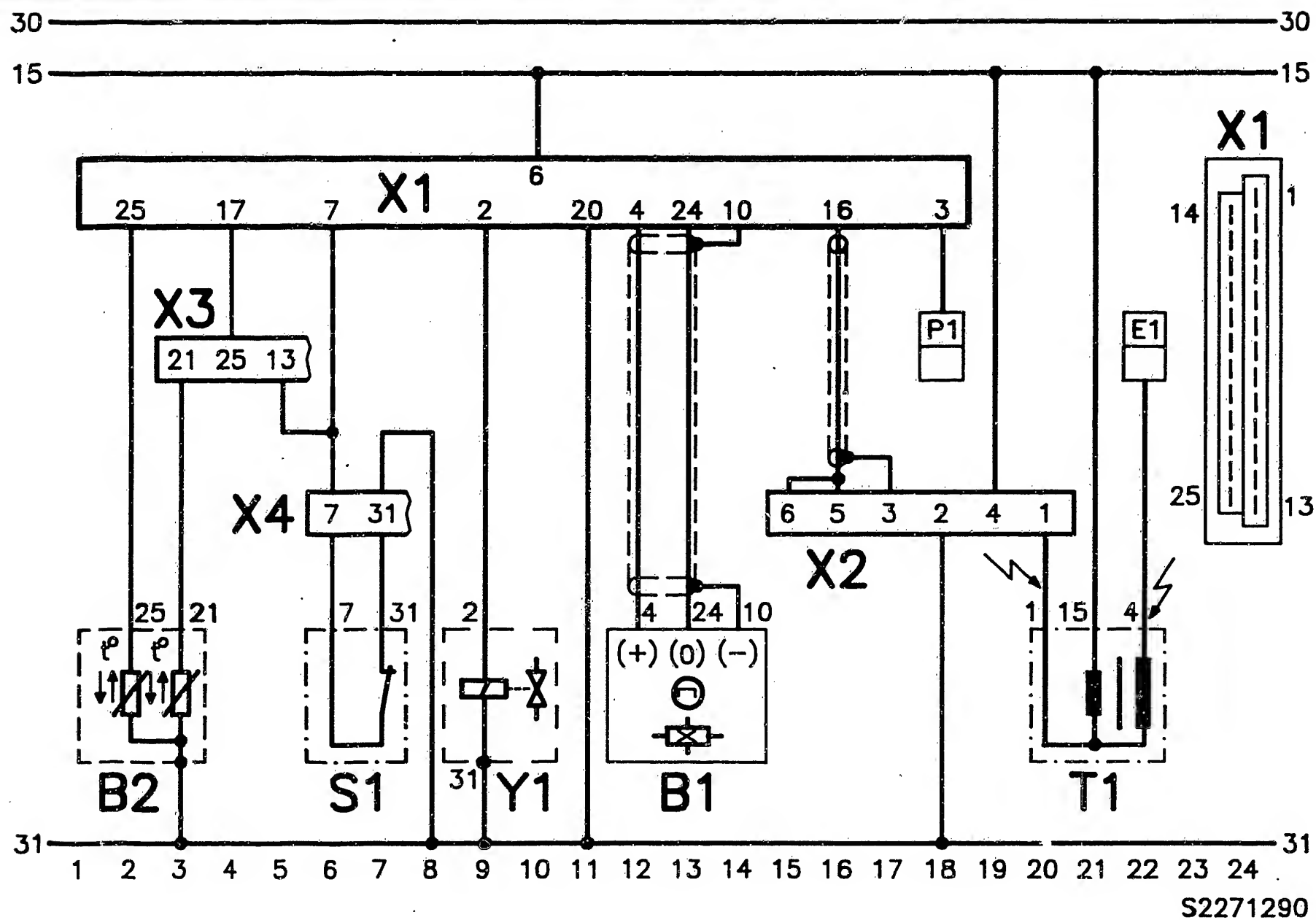
Be sure to observe safety and precautionary measures so as to avoid risk to persons and to prevent damage to the engine, trigger boxes, control units or the ignition system.

CAUTION!

High-energy ignition system with dangerous high and low voltages!

Touching live parts or terminals may be highly dangerous (both on the primary and secondary sides).

In this connection we should like to point out that VDE Regulations (in particular VDE 0104/7.67) and the pertinent local regulations are to be adhered to when performing work on or testing the ignition system.



High-tension arrows: caution 400 V...25 kV

T1 = Ignition coil

X2 = Trigger-box plug

SAFETY AND PRECAUTIONARY MEASURES (CONTINUED)

The hazardous locations are indicated with high-tension arrows taking the terminal diagram of an electronic ignition system as an example.

SAFETY AND PRECAUTIONARY MEASURES
(CONTINUED)

Never start engine without battery securely connected (battery terminals tightened).
Do not disconnect battery from vehicle electrical system with engine running.

Do not use a fast charger for starting the engine.
Provide starting assistance only with second 12 V battery and jump leads.
Caution! Owing to non-standardized requirements of vehicle manufacturers with regard to electronic products, we advise against using a 24 V battery for starting assistance.

When charging the battery in the vehicle or providing starting assistance, follow the operating instructions for the fast charger as well as instructions of the vehicle manufacturer.

Disconnect battery from vehicle electrical system before charging or fast-charging.

Incorrect polarity of the supply voltage, e.g. through incorrect connection of the battery or ignition coil, may lead to the destruction of a control unit.

Do not connect or disconnect wiring-harness plugs from control units or trigger boxes with the ignition on.

Remove control units at temperatures above + 80° C (paint-drying installation).

Remove control units before carrying out electric welding work.

SAFETY AND PRECAUTIONARY MEASURES
(CONTINUED)

When testing compression, detach trigger-box plug or permanently connect ignition coil term. 4 to ground with auxiliary cable (hazardous high tension, insulation damage on ignition coil, ignition distributor, ignition harness).

Note:

Auxiliary cable must feature at least 2 k Ω interference suppression, e.g. sleeve-type suppressor (5 k Ω)
0 356 500 001.

Prescribed ignition coil (see part no.) is not to be replaced with a different ignition coil.

An interference-suppression capacitor is not to be connected to term. 1 of the ignition coil.

The positive terminal of the battery is never to be connected to term. 1 of the ignition coil as this will destroy the trigger box.

Do not short-circuit term. 1 of ignition coil to ground (e.g. to switch off engine), as this will destroy the ignition coil and possibly also the trigger box.

Ignition cable from ignition coil and ignition distributor term. 4 must not be detached during operation.

There must be no voltage flashover from term. 4 of the ignition coil to term. 1 and term. 15 of the ignition coil.

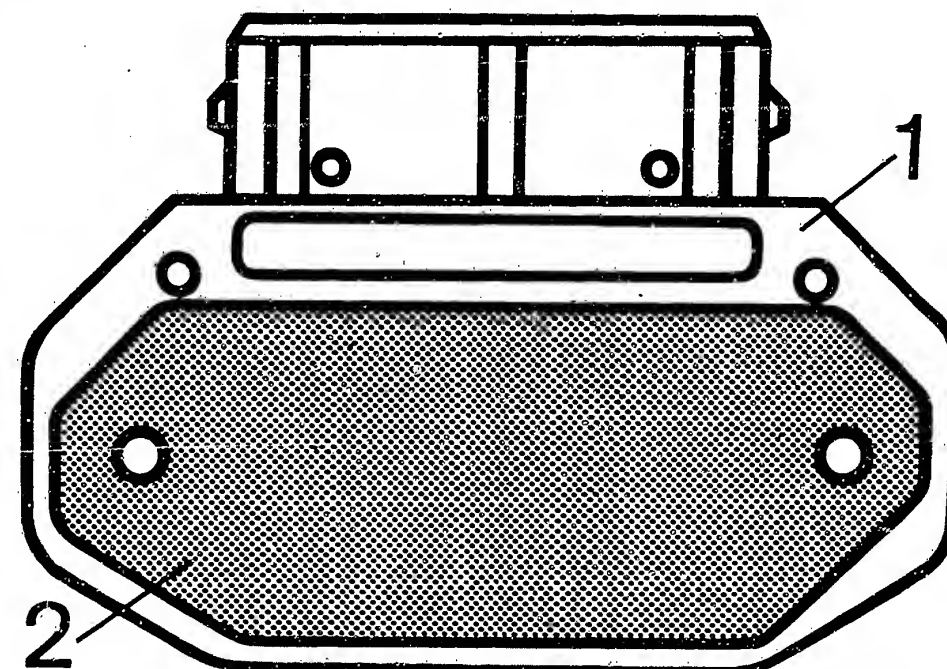
The secondary side of the ignition system must feature at least 2 k Ω interference suppression, so as to prevent destruction of the trigger box. The original distributor rotor must be fitted with 1 k Ω .

SAFETY AND PRECAUTIONARY MEASURES
(CONTINUED)

Incorrect indication of engine speed, dwell angle and ignition point:

With this ignition system (trigger box with current limitation) there is a possibility of an incorrect indication of engine speed, dwell angle and ignition point on testers.

Refer to coordinates N10-N17 for more detailed information



227/092

1 = Trigger box

2 = Base

SAFETY AND PRECAUTIONARY MEASURES
(CONTINUED)

The base must be coated with thermal conduction compound before installing the trigger box.

Only apply thermal conduction compound with a suitable implement (screwdriver, match etc.).
Do not apply thermal conduction compound to painted parts.

TESTERS AND TOOLS

Engine tester e.g. Mot 206	0 684 000 206
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Pulse-shaping circuit (required for measuring primary voltage with MOT 201, 206 and 400)	1 684 463 154
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Sleeve-type suppressor 5 k Ω	0 356 500 001
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Ohmmeter ETE 014.00 or e.g. Pontavi Wh 2	0 684 101 400 Commercially available
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Voltmeter e.g. ETE 014.00	0 684 101 400
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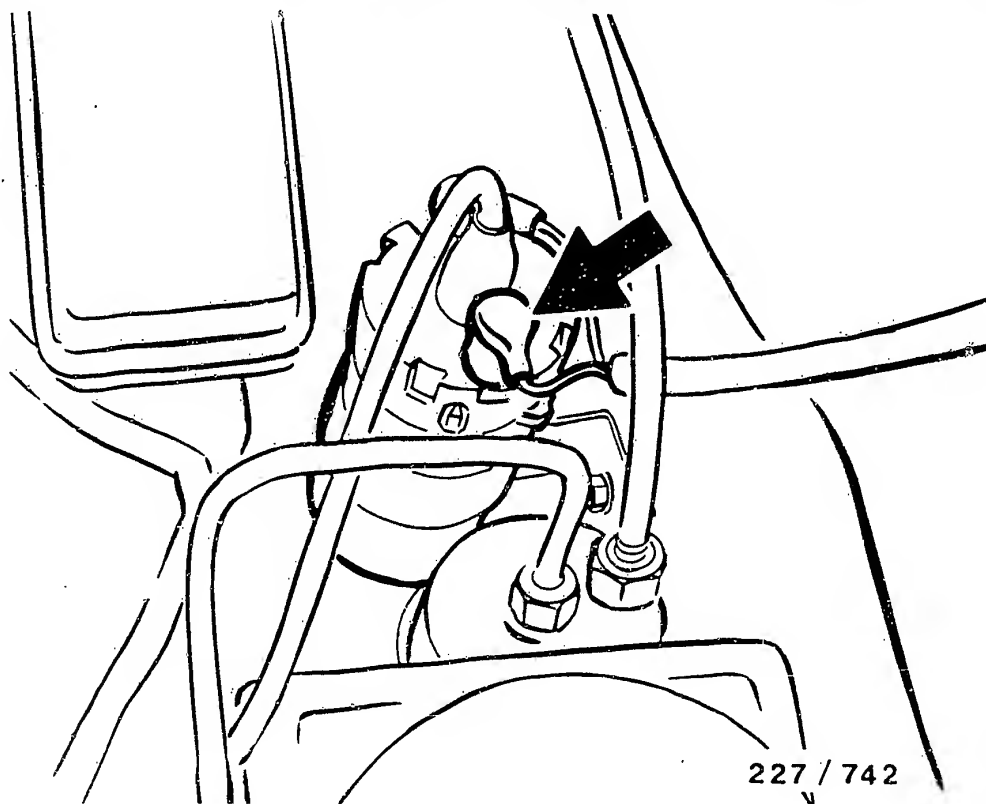
Test leads (for proper connection of testers to connectors)	KDZS 0004 KDZS 0005
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Test prod, black	1 684 485 034
Test prod, red (for proper connection of testers to connectors)	1 684 485 035

Connecting cable for ignition coil (for term. 1 green)	1 684 448 115
Connecting cable for ignition coil (for term. 15 yellow)	1 684 448 117

Thermal conduction compound	5 942 860 003
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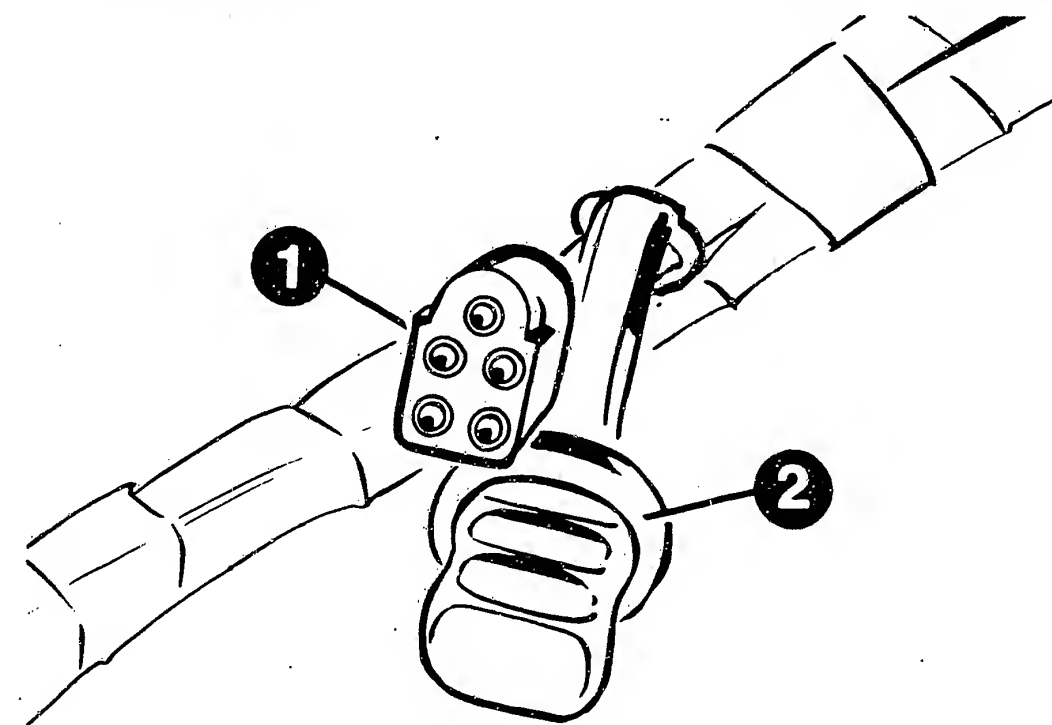
For production reasons:
continued on the following
coordinate.



Arrow = Ignition coil with trigger box

INSTALLATION POSITION OF COMPONENTS

The trigger box and ignition coil are located on a heat sink in the engine compartment, left in the vicinity of the master brake cylinder.

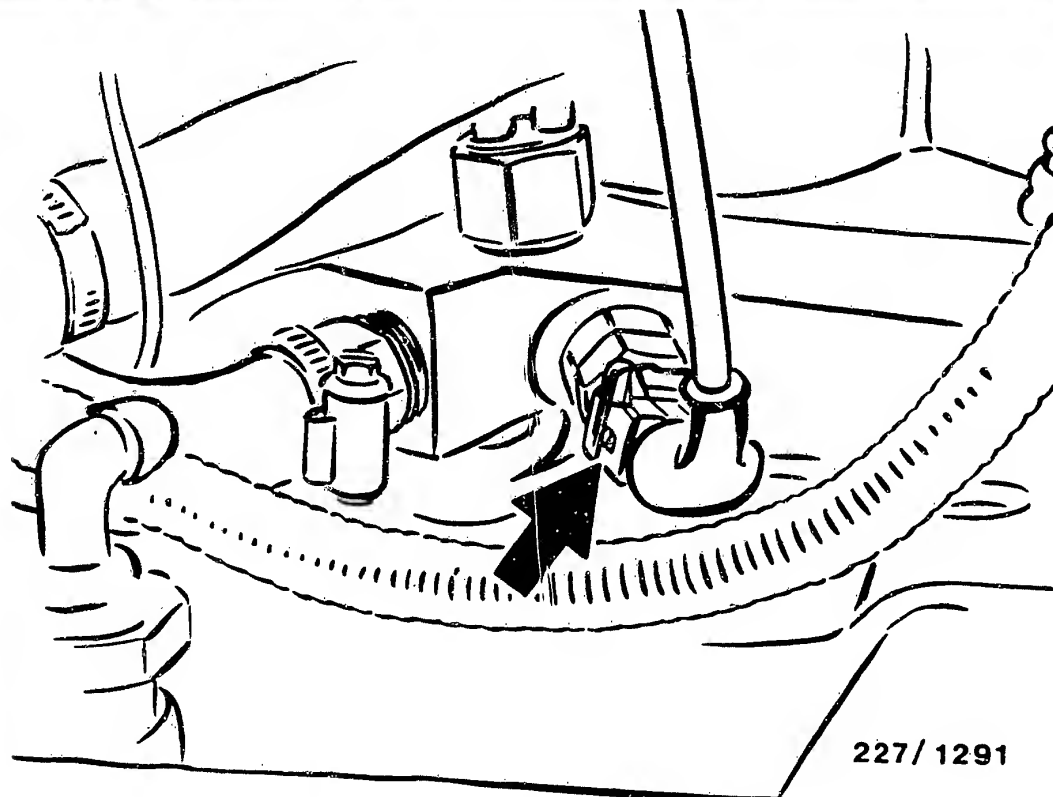


1 = Diagnosis connection

2 = Cap

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

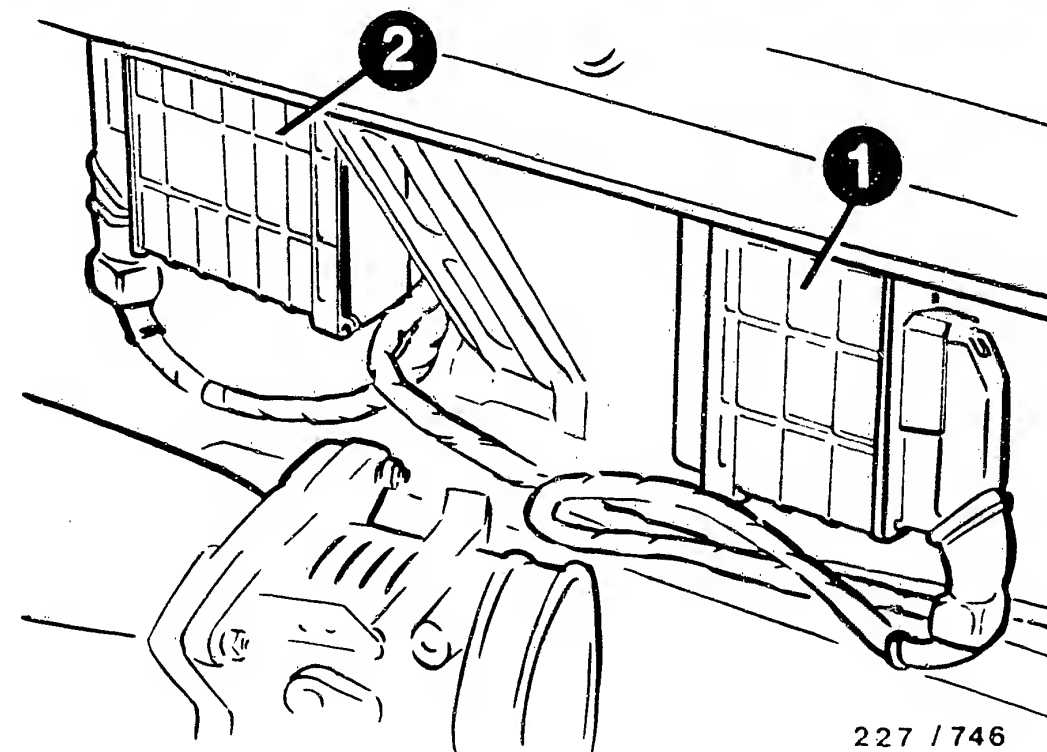
The diagnosis connection is located on the wiring harness (wheel house, left).



Arrow = Temperature sensor (coolant)

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The temperature sensor (coolant) is located on the cylinder head beneath the intake manifold.



1 = EI control unit
2 = KE-Jetronic control unit

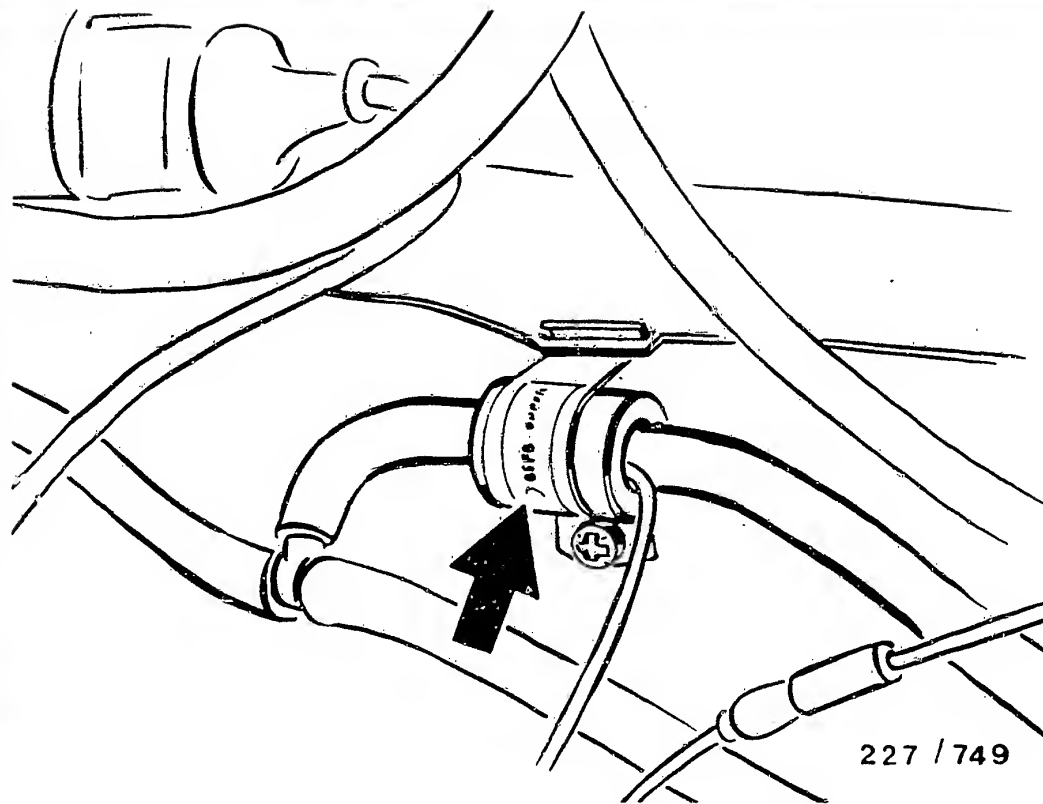
INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The EI control unit is located in the engine compartment behind the heating blower.

Removal instructions:
Detach rubber rim (not illustrated) from heating-blower shaft and loosen clamps.

Remove front section of blower shaft.

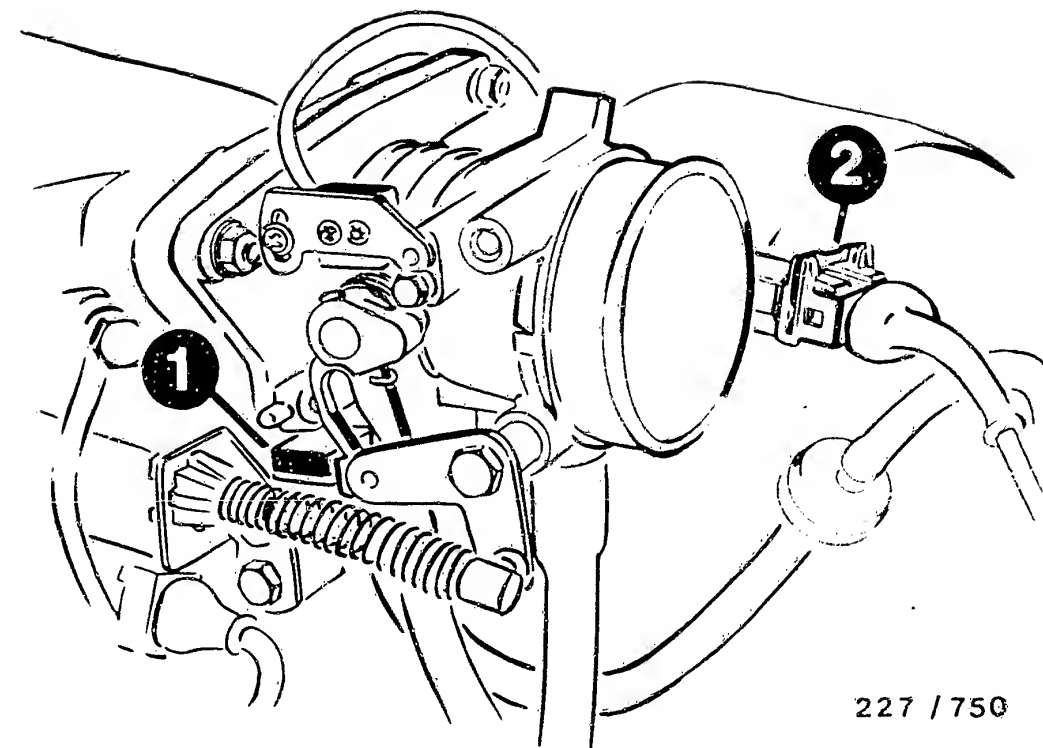
Unscrew both nuts of heating blower and remove heating blower assembly.



Arrow = Solenoid valve - idle compensation

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The solenoid valve is located at the engine bulkhead (on same level as oil filter).



1 = Microswitch - Idle contact

2 = Plug connection (idle - full-load contact)

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The microswitch - idle contact is located on the throttle-valve assembly.

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts with Coordinate B04 and contains customer complaint (fault symptom/fault characteristic feature) together with several possible causes in each case (component faults) and coordinate information for detailed trouble-shooting. If no coordinates are given, this is because the causes concerned do not require any test instructions.

In the event of a clearly established customer complaint, proceed consecutively and step by step as indicated in the trouble-shooting instructions in the stated sequence of possible causes.

Trouble-shooting should always be commenced with self-diagnosis (if provided) or with the universal test adapter (if envisaged). Only then should trouble-shooting be continued in line with the trouble-shooting chart.

In the event of a customer complaint which is not clear-cut, all causes indicated in the trouble-shooting chart must be tested. In order to avoid incorrect measurements, all causes are to be checked in the specified sequence (on account of interlinkage of test steps).

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

The TROUBLE-SHOOTING PROGRAM contains all system and component tests indicated in the trouble-shooting chart. It is sub-divided into three rows of boxes.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and fault elimination.

The right-hand column contains pictures/connection diagrams linked to the text together with explanatory notes.

If the questions posed in the left-hand column can definitely be answered with "yes", trouble-shooting is to be continued with the next box below.

If the answer to the question is "no", the center column must be applied and the tests performed in the sequence indicated there.

Following fault elimination, repeat test as a check.

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

TEST PREREQUISITES:

- Battery fully charged
- Engine in proper mechanical working order (e.g. compression, valve clearance etc.)
- Engine at operating temperature of approx. +80°C (if necessary)
- Proper connection of all connectors of wiring harness

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on.
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

											Cause (component fault)	Coord.
											* Self-diagnosis	B19
*		*	*	*	*	*					High-tension side	B21
*		*	*	*	*						Ignition coil	B23
*		*									Firing sequence	—
*											Ignition-distributor as-assembled setting	B25
*											Voltage, EI-control unit	B27
*											Voltage, trigger box	B27
*											Voltage, primary circuit	C01
*											Ignition-distributor plug and socket	C01
*											Magnetic pulse generator, voltage supply	C03
*											Magnetic-pulse-generator function	C05
*											EI-control unit function	C07
*											Contact resistances	C09
*											Primary signal	C13
		*	*		*	*		*			Temperature sensor (coolant)	B13

TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause(component fault)										Coord.	
						*				Microswitch - idle contact	C15
	*	*		*	*	*	*			Basic ignition setting	C17
	*									Solenoid valve - idle compensation	C19
		*		*	*	*				Vacuum sensor, EI-control unit	B17
			*							Voltage, ignition coil (engine idling)	C21
			*							Primary voltage Engine idling	C21

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND TROUBLE-SHOOTING PROGRAM

This vehicle is equipped with a control unit which has a self-diagnosis feature. Therefore, start trouble-shooting with the self-diagnosis.

How to activate the self-diagnosis is described starting on Coordinate B11. The self-diagnosis test table starting on Coordinate B13 contains:

- Fault indication (flashing code)
- Components or system functions under test
- Test instructions/test conditions
- Connection terminals
- Set-value specifications
- Coordinate references for trouble-shooting and fault rectification in the subsequent self-diagnosis trouble-shooting program.

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND
SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (CONTINUED)

The self-diagnosis trouble-shooting program is split up
into 3 columns as of Coordinate B15.

The left-hand column contains test instructions and set
values.

The center column contains information on trouble-
shooting and fault elimination.

The right-hand column contains pictures/terminal diagrams
belonging to the text together with explanatory notes.

If the questions posed in the left-hand column can
definitely be answered with "yes", trouble-shooting is to
be continued with the next box below.

If the answer to the question is "no", the center column
must be employed and the tests performed in the sequence
indicated there.

If the self-diagnosis indicates a fault, but there is no
system or component fault, the control unit is to be
replaced.

For production reasons:
continued on the following
coordinate.

If no further system-specific faults are indicated by the
self-diagnosis and the customer complaint (fault symptom)
has still not been eliminated, trouble-shooting must be
continued with the trouble-shooting chart as of
Coordinate B04.

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

Test prerequisite:

Fault lamp must light up with ignition "ON".
Engine speed at least 4500 min⁻¹.

Flashing-code evaluation:

The self-diagnosis is output in the form of a flashing code.

The flashing code consists of a flashing-pulse group with a maximum of 5 flashing pulses. See top picture.

The flashing pulses are recorded with the evaluation unit KDAW 9980 and evaluated (counted) by the person performing the test.

Note:

Cross-hatched area in picture signifies voltage pulses present (lamp lights up).

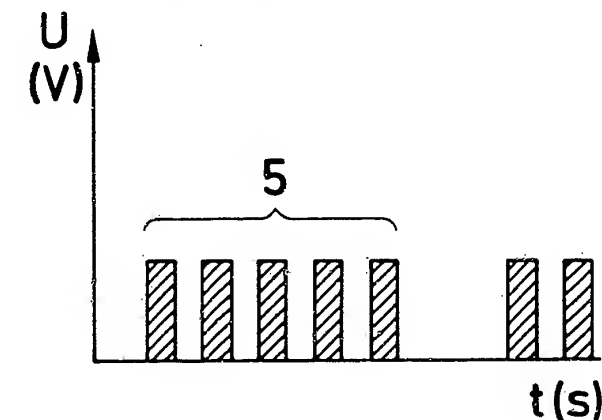
The flashing-pulse duration and the subsequent pause are approx. 0.5 s in each case when idling (function of engine speed).

Transmission of the last flashing pulse is followed by a pause of approx. 2 seconds.

Flashing code 5 is illustrated as an example in the top picture.

With this self-diagnosis only 1 fault is ever displayed. The first displayed fault must be eliminated before further faults can be interrogated.

The EI-control unit has a volatile memory. This means that the FAULT MEMORY IS CLEARED when the ignition is switched OFF.



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Note:

Cross-hatched area signifies fault lamp ON.

HOW TO USE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND TROUBLE-SHOOTING PROGRAM (CONTINUED)

ACTIVATION OF SELF-DIAGNOSIS

Detach vacuum hose from EI-control unit at intake manifold.

Connect evaluation unit KDAW 9980 with term. 1 to battery positive and term. 2 to diagnosis connection.
See top picture.

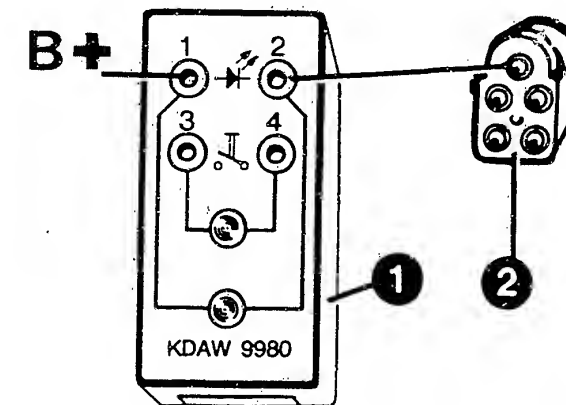
Ignition ON.

Lamp of evaluation unit KDAW 9980 must light up.
If lamp does not light up, carry out test step, Coordinate B19.
Then continue activation.

Start engine, run it briefly at > 4500 min⁻¹ and then allow it to idle.
Depending on the fault, the evaluation unit KDAW 9980 now indicates 2 or 5 flashing pulses which are evaluated using the self-diagnosis test table.
The fault concerned must then be eliminated.

The flashing code is repeated until the ignition is switched off.
The fault stored in the EI-control unit is thus also cleared.

Activation of the self-diagnosis with subsequent fault elimination must be repeated until no further fault code is output by the control unit.

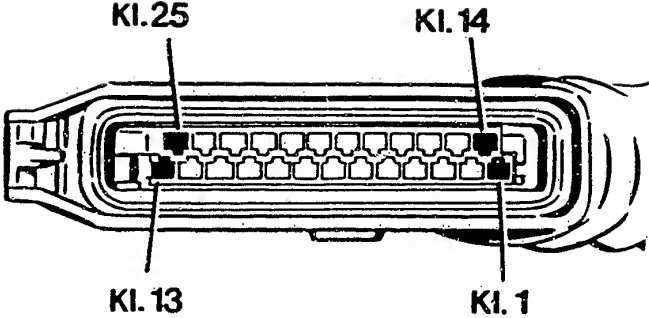


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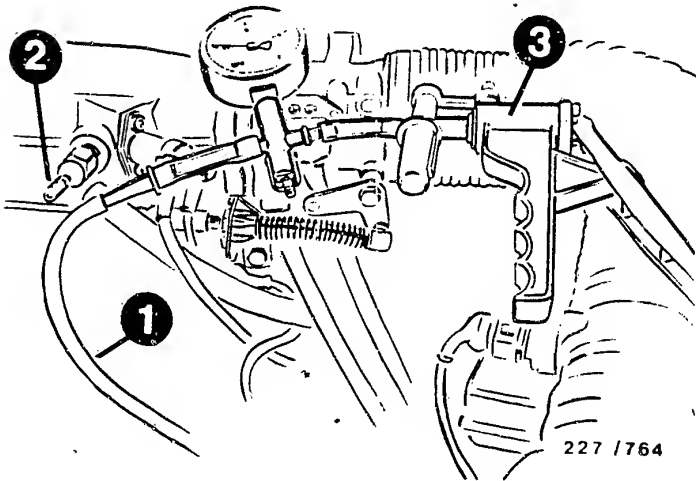
1 = Evaluation unit KDAW 9980
2 = Diagnosis connection

SELF-DIAGNOSIS TEST TABLE

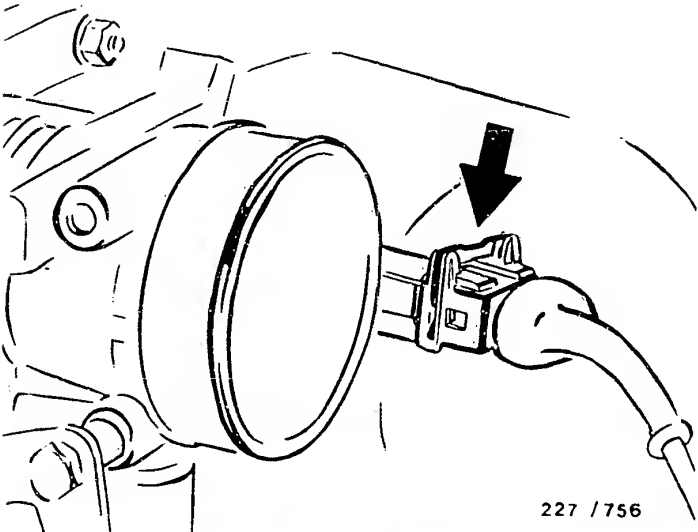
Fault indication Flashing code	Testing of component/function Test instructions/conditions	Termi- nals	Set values	Coor- dinate
2	TEMPERATURE SENSOR (COOLANT) Detach EI-control unit plug. See top picture. Resistance, EI-control unit plug and vehicle ground.	25 B-	See brief instruc.	B15
5	EI-CONTROL UNIT (LOAD SENSOR) Detach vacuum hose (1) from intake manifold (2) and connect to vacuum pump (3). (See center picture). Disconnect microswitch plug connection (idle contact) (see bottom picture, arrow). Allow engine to idle and establish ignition angle. Generate approx. 500 mbar (vacuum) with vacuum pump.		Ignition angle must be "ADVANCED".	B17



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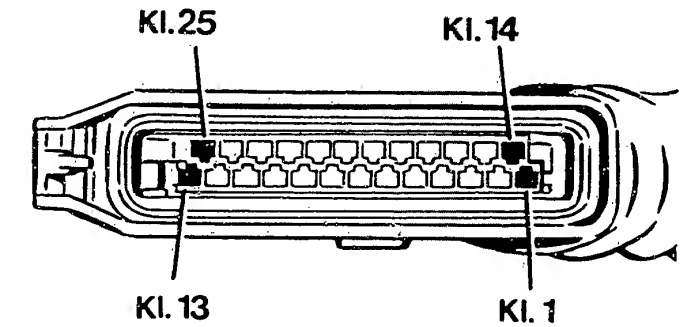
SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (1)

Temperature sensor (coolant)
Check for open circuit or short to ground.
There is no open circuit or short to ground in temperature sensor (coolant) if during SELF-DIAGNOSIS the evaluation unit KDAW 9980 did not indicate 2 flashing pulses.

Self-diagnosis O.K.?

N>

Check lead from temperature-sensor plug (coolant) term. 25 (bottom picture) to EI-control unit plug term. 25 (top picture) for open circuit or short to ground.
Eliminate open circuit or short to ground.



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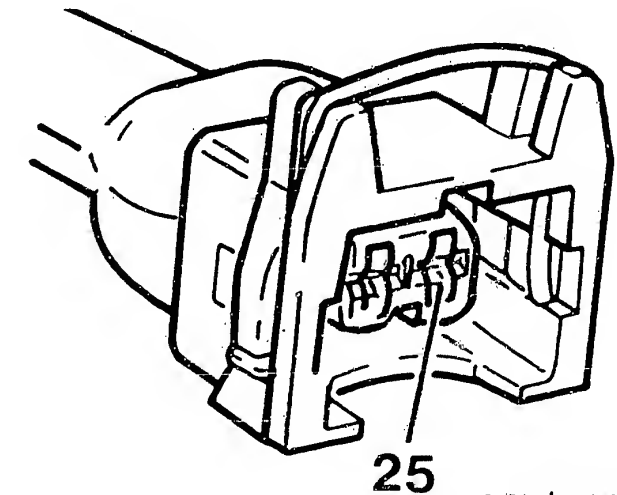
Connect ohmmeter to EI-control unit plug term. 25 and engine ground.
(Temperature-sensor plug attached)

Set value: see brief instructions

Is set value attained?

N>

Check lead from temperature-sensor plug (coolant) term. 25 to control-unit plug term. 25 for contact resistance.
Eliminate contact resistance.
If no fault was present, renew temperature sensor (coolant).



227/1297

Return to self-diagnosis
test table B13

B15

=>

B16

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SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (2)

Subject vacuum sensor (load sensor) to electrical testing.
The vacuum sensor is in proper electrical working order if during SELF-DIAGNOSIS the evaluation unit KDAW 9980 did not indicate 5 flashing pulses.
Self-diagnosis O.K.?

N>

Renew EI-control unit.

Check EI-control unit (load sensor) vacuum function.

N>

Detach vacuum hose (1) from intake manifold and connect it to vacuum pump.

See top picture.

Disconnect microswitch plug connection (idle contact).

See bottom picture. (Arrow)

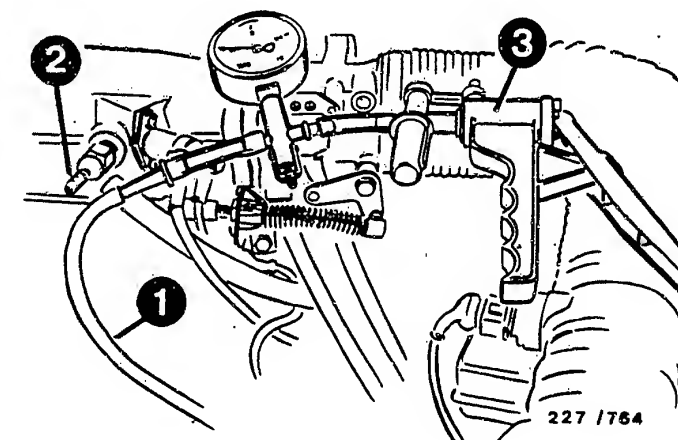
Allow engine to idle and establish ignition angle.

Generate approx. 500 mbar (vacuum) with vacuum pump.

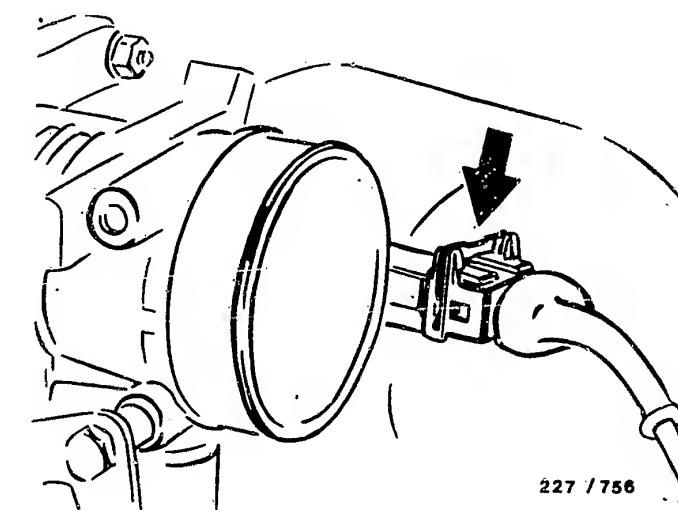
Ignition angle must be "ADVANCED".

Advancement?

Return to self-diagnosis test table B13



- 1 = Vacuum hose to EI-control unit
- 2 = Vacuum connection Intake manifold
- 3 = Vacuum pump



TROUBLE-SHOOTING PROGRAM (1)

Check self-diagnosis connection.

1. Connect analog voltmeter to battery positive and diagnosis connection.
See top picture.
Switch on ignition, voltmeter must indicate approximate battery voltage.

2. Start engine and run it briefly at > 4500 min. ⁻¹
Voltmeter must now indicate approx. 0 V or may show voltage pulses.

Voltage O.K. in items 1 and 2?

N>

1. If no battery voltage was indicated with item 1, detach EI-control unit plug (bottom picture) and check lead from EI-control unit plug term. 3 to diagnosis connection for open circuit.

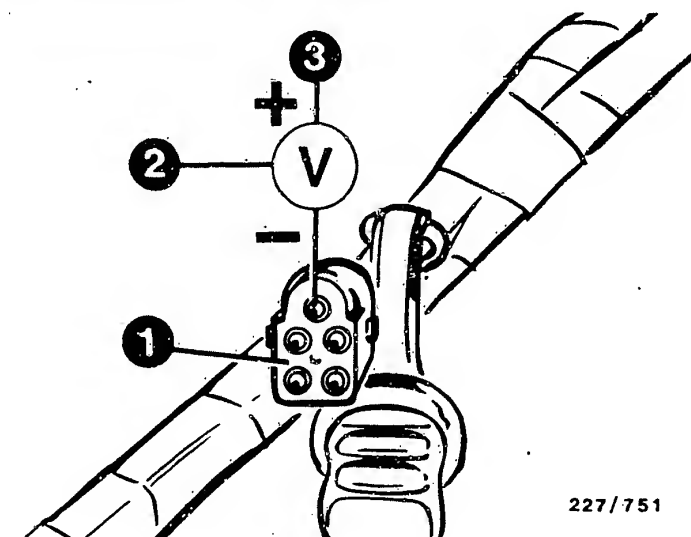
Eliminate open circuit.

Renew EI-control unit if there was no open circuit.

2. If battery voltage was continuously indicated with item 2, check lead from EI-control unit plug term. 3 to diagnosis connection for short to ground.

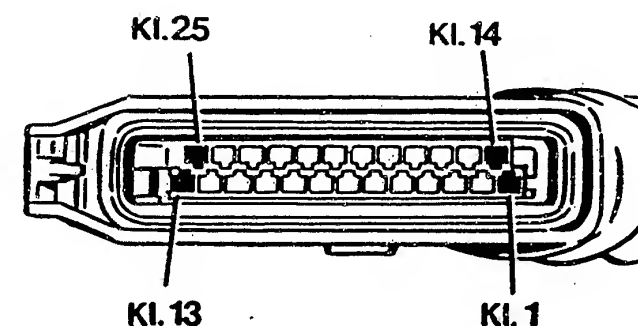
Eliminate short to ground.

Renew EI-control unit if there was no short to ground.



227/751

- 1 = Diagnosis connection
- 2 = Analog voltmeter
- 3 = Battery positive connection



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Return to trouble-shooting chart
B04

TROUBLE-SHOOTING PROGRAM (2)

V

Test high-voltage side.

N>

Repair high-voltage side.

Test spark plugs, spark-plug connectors, suppression resistors, H.T. ignition cables, distributor cap, distributor rotor etc. for proper operation (e.g. open circuit, shunt).

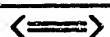
Assessment e.g. through ignition oscillogram, resistance measurements and visual check.

High-voltage side O.K.?

Y

Return to trouble-shooting chart
B04

B21



B22



Check ignition coil

Visual examination:

Remove protective cap from ignition coil and check whether plug is in position and whether sealing compound has escaped.
See picture.

Electrical check:

Ignition coil primary term. 15
and term. 1

(Take resistance of test lead
and test prods into account)

Set value: see brief instructions

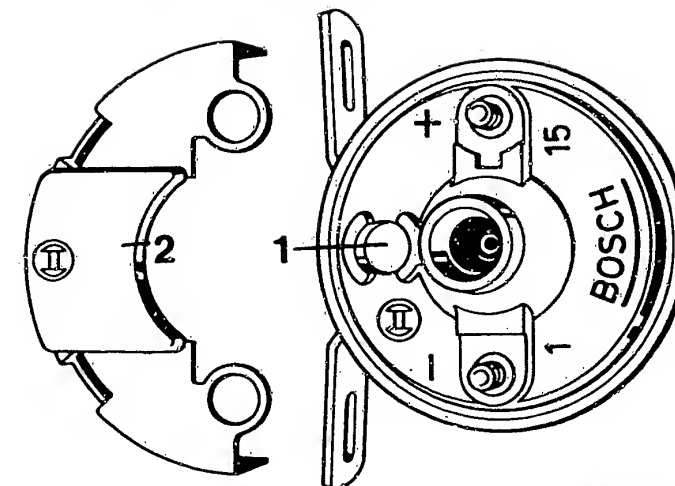
Ignition coil secondary term. 1
and term. 4

Set value: see brief instructions

Visual examination O.K./set value
obtained?

N>

1. If plug is not in position and/or sealing compound has escaped, replace trigger box and EI-K control unit and ignition coil.
2. If set values are incorrect, replace ignition coil.



227/0048

1 = Plug
2 = Protective cap

Return to trouble-shooting chart
B04

TROUBLE-SHOOTING PROGRAM (4)

Check ignition-distributor as-assembled setting.

Set crankshaft, cylinder 1 to mark on pulley 0° = TDC.
See top picture.

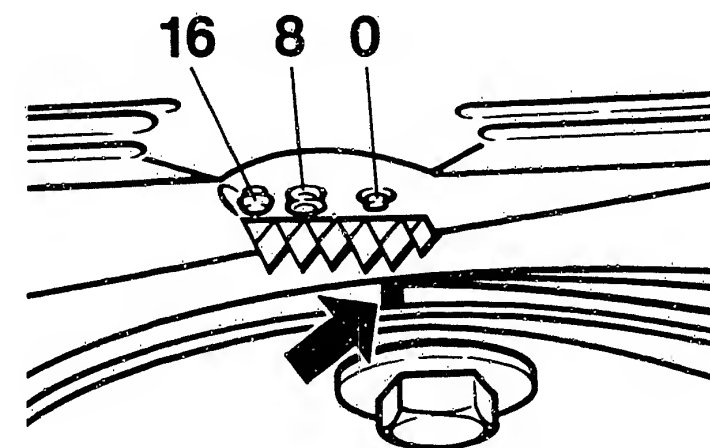
Remove cap, distributor rotor and dust cover from ignition distributor.

Attach distributor rotor.

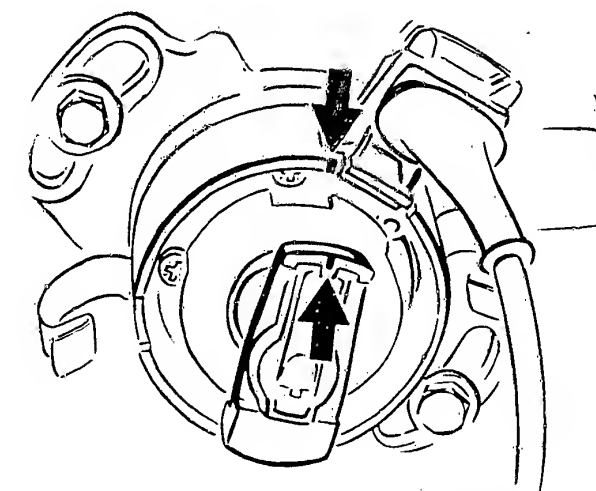
The distributor rotor must be situated such that the center of the distributor-rotor electrode faces the housing mark, cylinder 1. See bottom picture.
(Arrow)

Ignition-distributor as-assembled setting O.K.?

Adjust ignition distributor.



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Return to trouble-shooting chart B04

TROUBLE-SHOOTING PROGRAM (5)

Check voltage supply of EI-control unit.

Switch off ignition.

Detach EI-control unit plug and connect voltmeter to term. 6 (+) and term. 20 (-).
See top picture.

Switch on ignition.

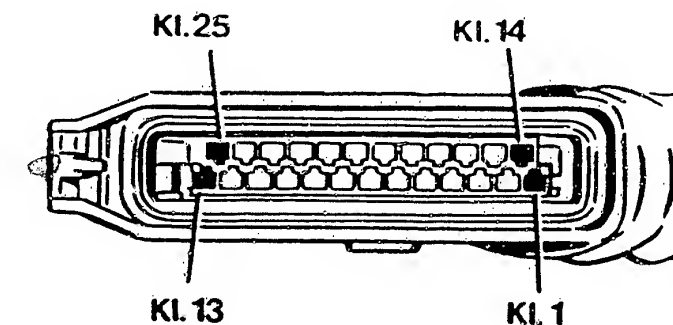
Set value: battery voltage

Is set value attained?

N>

Check lead from ignition/starting switch to EI-control unit plug term. 6 including ground lead term. 20 for open circuit.

Eliminate open circuit.



227 / 321

Check voltage, trigger box.

Detach trigger-box plug and connect voltmeter to term. 4 (+) and term. 2 (-).
See bottom picture.

Switch on ignition.

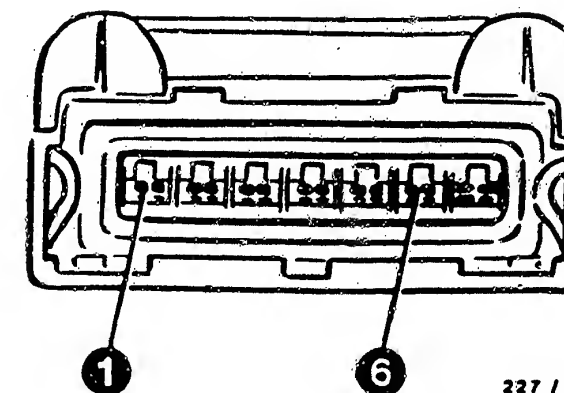
Set value: battery voltage

Is set value attained?

N>

Check for open circuit in leads and connections between ignition/starting switch and trigger-box plug term. 4 including ground lead term. 2.

Eliminate open circuit.



227 / 1200

Return to trouble-shooting chart B04

TROUBLE-SHOOTING PROGRAM (6)

Check voltage, primary circuit.

Detach trigger-box plug and connect voltmeter to term. 1 (+) and term. 2 (-).

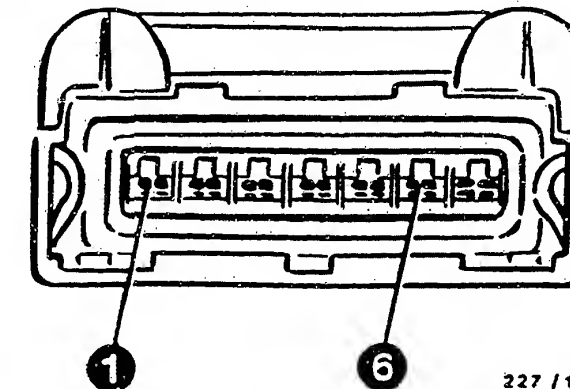
See top picture.
Switch on ignition.

Set value: battery voltage

Is set value attained?

N>

Test for open-circuit in lead from ignition and starting switch to ignition coil term. 15, primary winding of ignition coil and lead from ignition coil term. 1 to trigger-box plug term. 1 including ground lead term. 2.
Eliminate open-circuit.



227 / 1200

Check ignition-distributor plug and socket.

Press wire catch off ignition-distributor plug.

Detach ignition-distributor plug.

Visual inspection:
Check contacts of ignition-distributor plug and socket for oxidation.

Contacts O.K.?

N>

Eliminate oxidation.

Return to trouble-shooting chart B04

C01

<=>

C02

<=>

TROUBLE-SHOOTING PROGRAM (7)

Check voltage, magnetic pulse generator.

Ignition-distributor and EI-control unit plug is attached.

Push back rubber sleeve of ignition-distributor plug.

Connect voltmeter to ignition-distributor plug term.4 (+) and term.10 (-).
See top picture.

Switch on ignition.

Set value equal to/greater than 10 V

Is set value attained?

N>

Ignition OFF
Detach ignition-distributor plug.

Connect voltmeter to ignition-distributor plug term.4 (+) and term.10 (-).

Ignition ON.
If voltage is less than 10 V, check lead from ignition-distributor plug term.4 to EI-control unit plug term.4 for short to ground.

Renew EI-control unit if there was no short to ground.

Renew magnetic pulse generator if voltage is equal to/greater than 10 V.

If voltage is 0 V, then connect ohmmeter consecutively to:

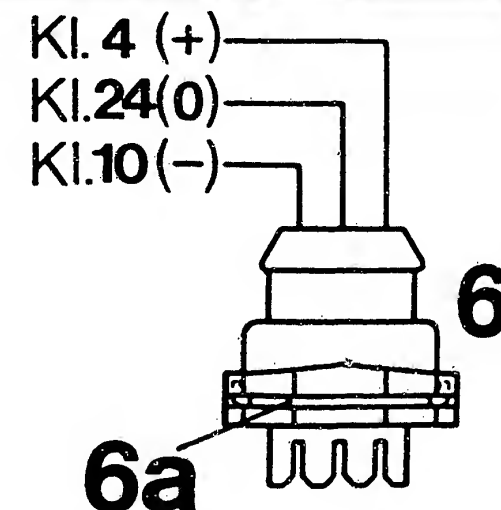
Ignition-	EI-control
distributor	unit
plug	plug

Term. 4	and	term. 4
Term.10	and	term.10

Set value: approx. 0 Ω in each case (continuity).

Eliminate open circuit.

Renew EI-control unit if there was no open circuit.



227 I 617

6 = Ignition-distributor plug
6a = Wire catch

Return to trouble-shooting chart
B04

TROUBLE-SHOOTING PROGRAM (8)

Check magnetic-pulse-generator function.

Ignition-distributor and EI-control unit plug is attached.

Push back rubber sleeve of ignition-distributor plug.

Connect oscilloscope in program-selector-switch setting "Special" in accordance with operating instructions.

For example MOT. 206:

Red terminal to ignition-distributor plug term. 24 (measurement signal).

See top picture.

Black terminal to vehicle ground.

Start engine.

Oscilloscope must indicate rectangular pulse.

See bottom picture.

Rectangular pulse present?

N>

Ignition OFF.

Detach ignition-distributor plug and EI-control unit plug.

1.
Check lead from ignition-distributor plug term.24 to EI-control unit plug term.24 for open circuit, short to ground or short to positive.

Eliminate fault.

Attach EI-control unit plug.

2.
Connect voltmeter to ignition-distributor plug term.24 (+) and vehicle ground (-).

N o t e :

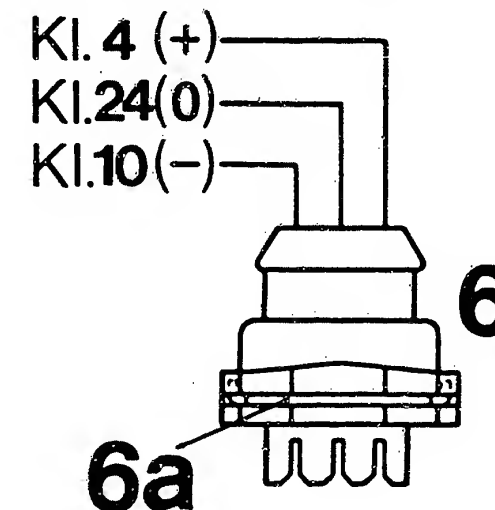
Use voltmeter with internal resistance (R_i) greater than $50\text{ k } \Omega / \text{V}$ (otherwise incorrect measurement).

Ignition ON.

Set value: equal to/greater than 2 V.

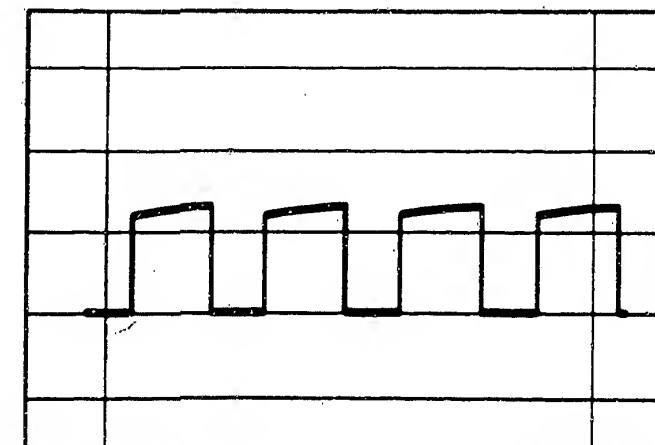
Renew EI-control unit if set value was not attained.

Renew magnetic pulse generator/ignition distributor if items 1 and 2 were O.K.



227 / 617

6 = Ignition-distributor plug
6a = Wire catch



22710096

Return to trouble-shooting chart B04

TROUBLE-SHOOTING PROGRAM (9)

Check EI-control unit function.

Ignition-distributor and EI-control unit plug are attached.

Detach trigger-box plug.

Connect oscilloscope in program-selector-switch setting "Special" in accordance with operating instructions.

For example MOT 206:

Red terminal to trigger-box plug term. 5 or term. 6 (measurement signal)
See top picture.

Black terminal to vehicle ground.

Start engine.

Oscilloscope must indicate rectangular pulse.
See bottom picture.

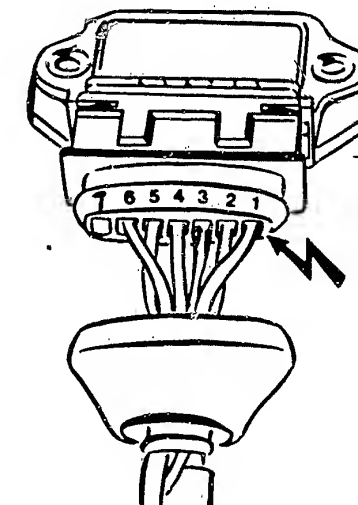
Rectangular pulse present?

N>

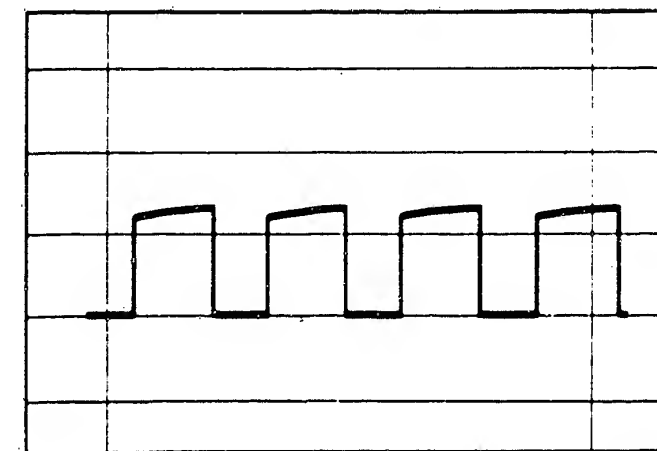
Check lead from EI-control unit plug term.16 to trigger-box plug term.5 or 6 for open circuit, short to ground or short to positive.

Eliminate fault.

Renew EI-control unit if there was no fault present.



227 / 1292



227IC096

Return to trouble-shooting chart B04

C07

<=>

C08

<=>

TROUBLE-SHOOTING PROGRAM (10)

Test contact resistance (primary side).

Detach negative and positive lead of battery.

Detach trigger-box plug.
See picture.

Switch on ignition.

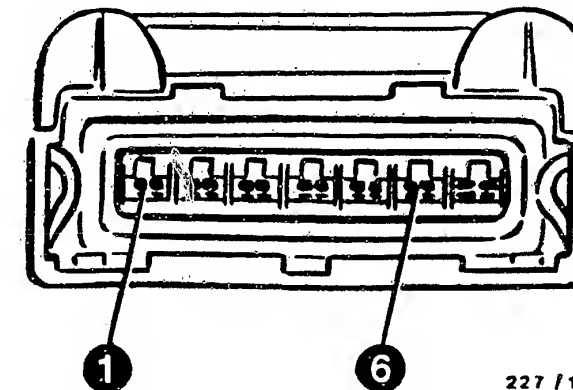
Test for contact resistance in leads from battery positive terminal to trigger-box plug term. 4 including leads from battery negative terminal to trigger-box plug term. 2.

(Take account of resistance of test leads/test prods.)

Set value: see brief instructions

Is set value attained?

Eliminate contact resistance.



227 / 1200

Continued on next picture page

TROUBLE-SHOOTING PROGRAM (10) CONTINUED (1)

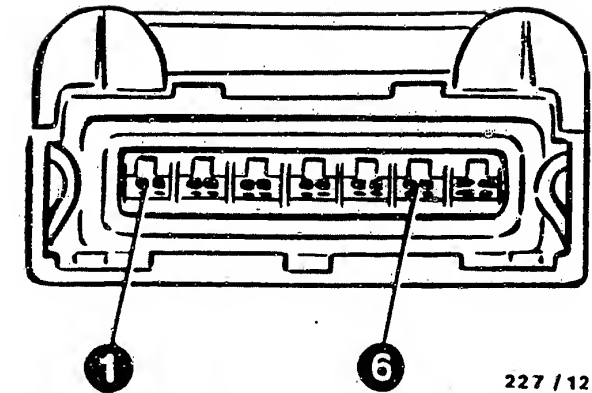
Test for contact resistance in leads from positive battery terminal to ignition coil term. 15 as well as in lead from ignition coil term. 1 to trigger-box plug term. 1.
See picture.
(Take account of resistance of test lead/test prods).

Set value: see brief instructions

Is set value attained?

N>

Eliminate contact resistance.



227 / 1200

Return to trouble-shooting chart
B04

C11

<==>

C12

<==>

TROUBLE-SHOOTING PROGRAM (11)

V

Test primary signal.

Trigger-box plug connected.

Primary signal with oscilloscope

Connect oscilloscope as per operating instructions to ignition coil term. 15 (+) and term.1 (-).

Start engine.

Set value:

Oscilloscope must indicate a primary voltage (of any magnitude). See picture.

O R

Primary signal with engine-speed tester

Connect engine-speed tester as per operating instructions to ignition coil term. 15 (+) and term. 1 (-).

Start engine.

Set value:

Engine-speed tester must indicate a value (irrespective of magnitude).

Primary signal present?

N>

Renew trigger box.

Y

V

Return to trouble-shooting chart
B04



227/1100

C13

<==>

C14

<==>

TROUBLE-SHOOTING PROGRAM (12)

Check microswitch - idle contact.
Ignition off.
Detach EI-control unit plug and
connect ohmmeter to
term.7 and vehicle ground.
See top picture.
Throttle valve is closed.
Ohmmeter must indicate approx. $0\ \Omega$.
Open throttle valve approx. 2° .
Ohmmeter must indicate infinity Ω .

Resistance value O.K.?

N>

Detach plug from idle-contact
switch.
See bottom picture.
Connect ohmmeter consecutively to:

Idle-contact plug	EI-control unit plug
Term. 7	and term. 7
Term.31	and vehicle ground

Ohmmeter must indicate approx.
 $0\ \Omega$.

Eliminate open circuit if resistance
is infinity Ω .

Connect ohmmeter to idle-contact
switch term.7 and term.31.

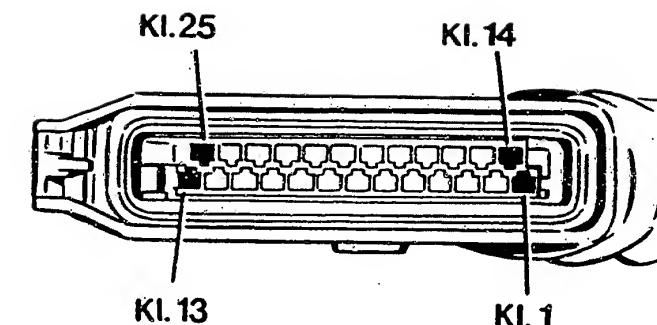
Throttle valve is closed.
Ohmmeter must indicate approx.
 $0\ \Omega$.

Renew microswitch if resistance
value is infinity Ω .

Open throttle valve approx. 2°

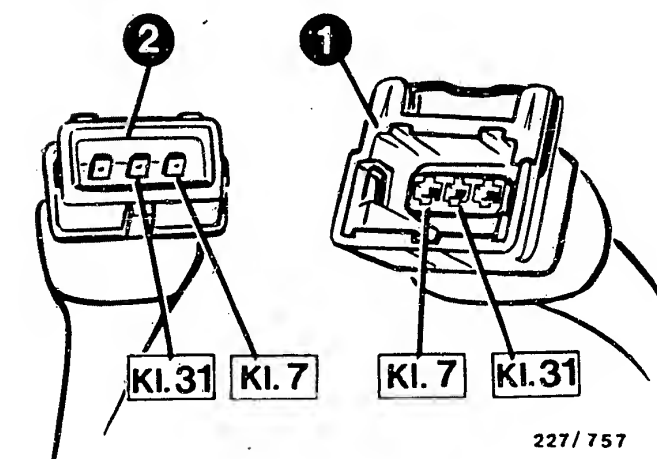
Ohmmeter must indicate
infinity Ω .

Renew microswitch if resistance
value is $0\ \Omega$.



227 / 321

- 1 = Plug, idle/full-load
contact switch
- 2 = Plug connection, idle/full-
load contact switch



227 / 757

Return to trouble-shooting chart
B04

TROUBLE-SHOOTING PROGRAM (13)

Check basic ignition setting.

Vacuum hose of EI-control unit is attached.

Allow warm engine to idle at $900 \pm 25 \text{ min}^{-1}$.

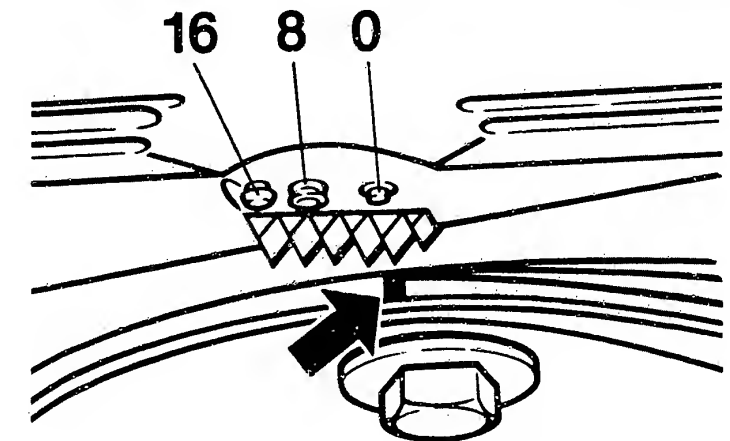
Throttle valve in idle position (idle contact closed).

Aim lamp at ignition firing point mark.

Set value: $12 \pm 1^\circ \text{ BTDC}$.

Is set value attained?

Turn ignition distributor until set value is attained.



Return to trouble-shooting chart B04

C17

<=>

C18

<=>

TROUBLE-SHOOTING PROGRAM (14)

Check solenoid valve - idle compensation.

1. Ignition off.
Detach plug connection of solenoid valve.
Connect voltmeter (+) to plug connection (top picture, item 1) and (-) to vehicle ground.

Ignition ON.

Voltmeter must indicate approx. battery voltage.

2. Run engine at $> 1000 \text{ min}^{-1}$.
Voltmeter must indicate 0 V.

3. Allow engine to idle and switch on electrical loads (lights, heated rear window etc.).
Note down idle speed.

Connect plug connection (top picture, item 2) to battery positive.
There must be a slight increase in idle speed (approx. 100 min^{-1}).

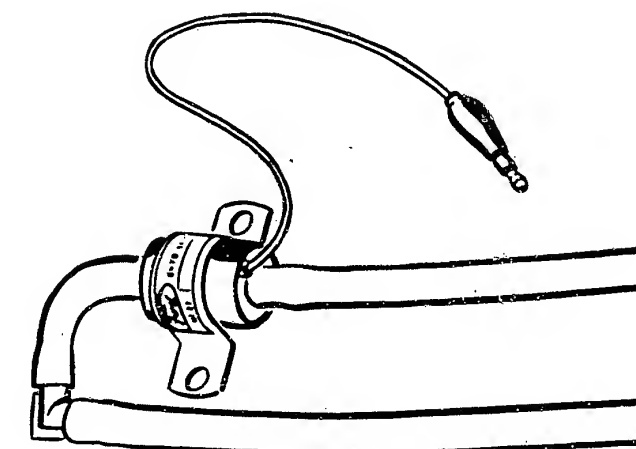
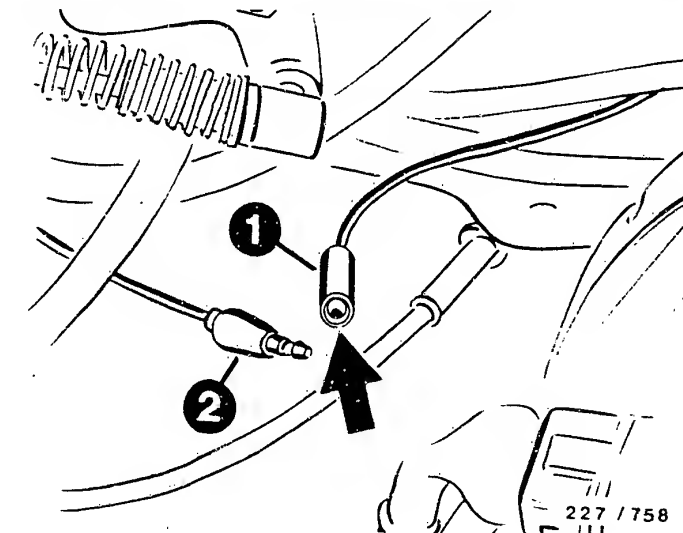
Test steps 1, 2 and 3 O.K.?

N>

Test step 1 not O.K.
Check lead from plug connection (top picture, item 1) to EI-control unit plug for open circuit. Eliminate open circuit.
Renew EI-control unit if there was no open circuit.

Test step 2 not O.K.
Check lead from plug connection (top picture, item 1) to EI-control unit plug term. 2 for short to positive. Eliminate short to positive.
Renew EI-control unit if there was no short to positive.

Test step 3 not O.K.
Connect ohmmeter to plug connection (top picture, item 2) and vehicle ground.
Resistance $24...40 \Omega$.
Renew solenoid valve if resistance not O.K.
Check hose connection from throttle-valve assembly to solenoid valve for leaks.
See bottom picture.



Return to trouble-shooting chart B04

TROUBLE-SHOOTING PROGRAM (15)

V

Test ignition-coil voltage.

Connect voltmeter to ignition coil term. 15 (+) and battery negative terminal (use connecting cable for ignition coil).

Allow engine to idle.

Set value: at least 10 V

Is set value attained?

N>

Disconnect positive lead from battery; switch on ignition.

Check for contact resistance in leads between positive battery terminal and ignition coil term.15.

Contact resistance may be max. 0.3 Ω (take resistance of test prods and test leads into account)

Eliminate contact resistance.

Y

Test primary voltage.
(If MOT series present)

N>

Connect oscilloscope (e.g. MOT 206) together with pulse-shaping circuit 1 684 463 154 to ignition coil as per operating instructions.

N o t e :

Incorrect measured value without pulse-shaping circuit.

Allow engine to idle.

Set value: see picture/brief instructions

Is set value attained?

Y



227/957

Replace trigger box.

TECHNICAL BULLETIN

DANGER OF ACCIDENT ON SEMI-
CONDUCTOR IGNITION SYSTEMS

|22|
VDT-I-227/102 En
03.1981

Supersedes Feb. 3, 1976 edition

Please be sure to pass this bulletin
together with VDE 0104/7.67 enclosed on to your
employees for their attention.

The increased demands made on their ignition
systems by modern engines, and the wish for freedom
from maintenance, led some time ago to manufacturers
starting to equip their vehicles with semi-conductor
ignition systems as original equipment.
In most cases, the performance of nearly all
makes of such systems is higher than that of
conventional systems, and further improvements are
to be expected. This means that semi-conductor
ignition systems have reached the point where
contact with "live" components or terminals
(whether on the primary side or the secondary side)
can prove fatal.

In this connection, we should like to point out
to you that the laws valid in your country
regarding work on high-voltage systems must
be adhered to when working on, or testing,
semi-conductor ignition systems.

As a matter of principle, when working on such
ignition systems, the ignition is to be
switched off.

Included in such work are the following operations:

- * Connection of engine testing equipment
(timing strobe, dwell-tach tester, ignition
oscilloscope etc.)
- * Replacement of ignition system components
(spark plugs, ignition coil, ignition
distributor, H.T. ignition cables etc.)

If it is necessary to switch on the ignition
in order to test the system or make adjustments
on the engine (to the carburetor, for instance),
then lethal voltages are present throughout
the entire system.

This means that the danger of accident exists
not only at the individual components in the
system (e.g. ignition distributor, ignition
coil, trigger box, ignition harness), but also
at the wiring harness (e.g. connection for the
tachometer, diagnostic connector), on terminals,
and on test equipment.

In addition, in the case of the capacitor-discharge
ignition system (CDI), danger of accident is also
present under the following circumstances:

- * Operation of the trigger box without the
ignition transformer.
- * At the trigger box, (removed), relatively
soon after it has been switched off
(capacitor discharge).

Below is a typical terminal diagram of a semi-
conductor ignition system, the dangerous
locations being marked with high-voltage arrows.

We would point out that all semi-conductor
ignition systems, even the older versions, are
to be regarded as dangerous in the sense as
defined by this bulletin.

EFFECTS OF ELECTRICAL AND ELECTRONIC SYSTEMS ON HEART PACEMAKERS

VDT-I-227/107 En
01.1981

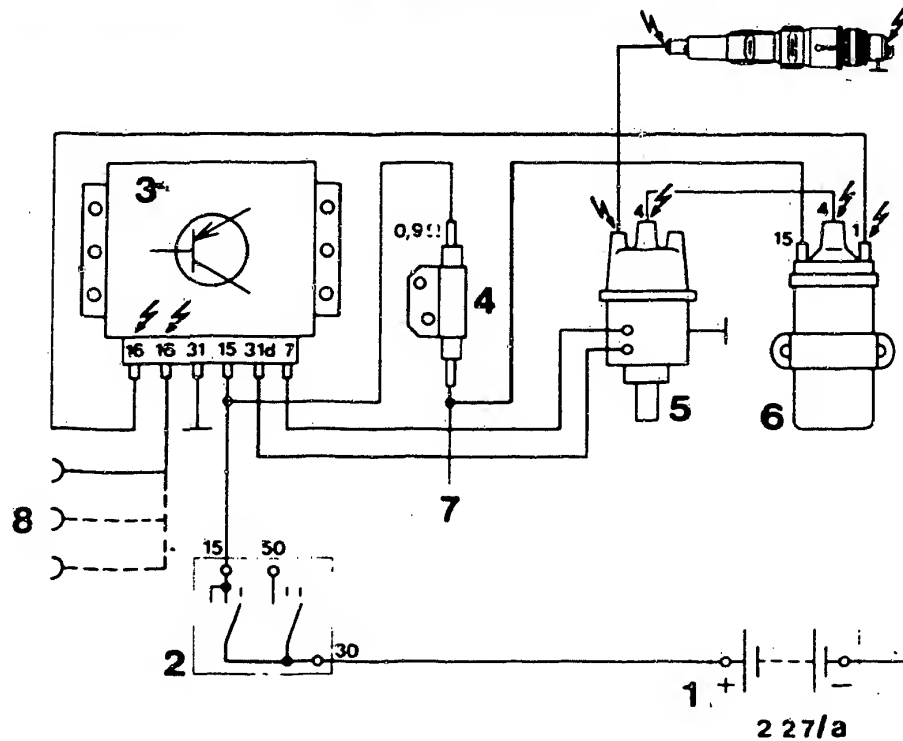
e.g. Ignition systems, Jetronic, Motronic, ABS

Please ensure that this Bulletin is passed
on to your employees for their attention.

We have often been asked by some of our
customers whether or not patients with heart
pacemakers are endangered in any way by
ignition systems. This theme was recently
the subject of an examination carried out by
the Ignition System Development Department of
Robert Bosch GmbH in conjunction with Dr.
Thull, lecturer at the Central Institute for
Biomedical Technology at the University of
Erlangen-Nürnberg and Biotronic GmbH & Co.
of Berlin, a manufacturer of heart pacemakers.
The magazine "Biomedizinische Technik"
(5/80) published the results.

The most important discoveries in this practice
can be summarized from the examination report
as follows:

1. Heart pacemakers corresponding to the
latest state of the art are not affected
by radiation (electromagnetic fields) from
ignition systems.
2. With a stationary engine and the ignition
switched off, the heart pacemaker is not
affected by any part of the ignition system,
even when unintentionally touched. Main-
tenance work in the engine compartment, for
example, can then be carried out without
any danger.



- 1 = Battery
- 2 = Ignition/starting switch
- 3 = Trigger box
- 4 = Resistor
- 5 = Ignition distributor
- 6 = Ignition coil
- 7 = to starting motor term. 15a
- 8 = to tachometer connection
or diagnostic plug
or TD terminal

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments
concerning the contents to our authorized
representative in your country.

3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency). Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.
4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers, please introduce the necessary measures.

We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.

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TECHNICAL BULLETIN

NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDT-I-227/108 En
01.1983
Supersedes 5.1981 edition

The introduction of new ignition systems has made it necessary to reclassify all designations.

The designations listed below will be used immediately in KH workshop and sales literature.

Designation	Abbreviated code	Meaning	Switching	Ignition ctrl. and spark adv.	High-voltage dist.
Coil ignition	ZS (CI)		Mechanical (breaker points)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized coil ignition	TSZ-K (TCI-c)	K=breaker-triggered	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Trigger box with conventional circuit techniques	TSZ-I * (TCI-1)	I=Induction-type pulse gen.	Electronic (trigger box)	Mechanical (ignition dist.)	Mechanical (ignition dist.)
	TSZ-H (TCI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition dist.)	Mechanical (ignition dist.)

Designation	Abbreviated code	Meaning	Switching	Ignition ctrl. and spark adv.	High-voltage dist.
Transistorized ignition	TZ-I * (TI-1)	I=Induction-type pulse gen.	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
(Trigger box in hybrid technique)	TZ-H * (TI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Breakerless semi conductor ignition with or without knock control	EZ (EI) (EZ-K) (EI-k)	K=Knock control	Electronic (trigger box or control unit)	Electronic (control unit)	Mechanical (ignition distributor or high-voltage distributor)
Distributor-less ignition with or without knock control	VZ (FEI) (VZ-K) (FEI-k)	K=Knock control	Electronic (control unit)	Electronic (control unit)	Electronic (dual-spark ignition coil, or 1 ignition coil for each spark plug)

* Note:

The ignition system can also be equipped with a DLS unit (digital idle stabilization) or with an ELS unit (electronic idle stabilization) or with an ESV unit (electronic ignition retardation).

MOTOR VEHICLE SERVICE INFORMATION

INCORRECT DISPLAY OF ROTATIONAL SPEED VDT-I-Gen. 030 En
AND DWELL ANGLE ONLY WITH TRIGGER 02.1981
BOXES 0 227 100 .. (TCI-l, TCI-h)
WITH CURRENT LIMITATION Supersedes ed. 6.1980

For additional information, see VDT-I Gen. 032 En

1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period, the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT 001.00	Rotational-speed	KTE 001.00
001.01	display O.K. with	001.02
001.02	these testers	001.03
001.04		
002.00		

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild ignition system)	Mazda	(Mitsubishi ignition system)
BMW	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan	(Hitachi ignition system)
Fiat	(Delco ignition system)	Datsun	(Bosch ignition system)
Ford	(Delco ignition system)	Peugeot	(Bosch/Fairchild ignition system)
General Motors	(HEI ignition system)	VW	(Bosch transistorized ignition system for retrofitting)

0 227 100 920

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2. Test instructions

2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from 2400 min^{-1} to 1200 min^{-1}).

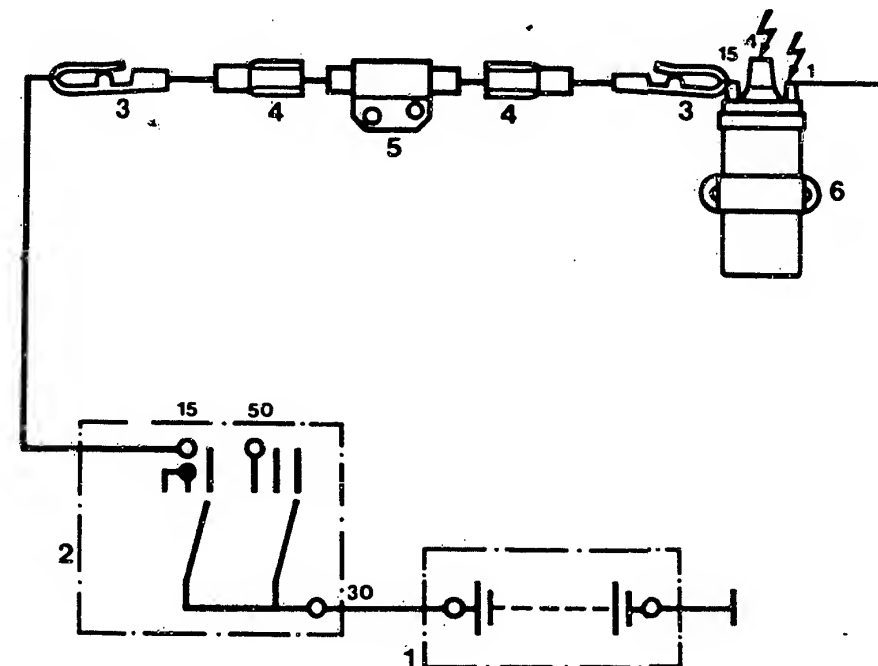
It is, however, possible to attain correct rotational-speed measurements:

Connect a ballast resistor of 0.9 or 1.0 Ohms (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.

Suggestion for user manufacture

Required parts:

1 ballast resistor 0.9 Ohms	Part no. 0 227 900 002
or	
1 ballast resistor 1.0 Ohms	Part no. 0 227 900 101
2 blade receptacles	Part no. 1 901 355 881
e.g. approx. 0.2 m cable,	
1.5 mm ² e.g.	Part no. 6 210 150 150
2 insulated clips	Commercially available



227/d

- | | |
|------------------------------|----------------------|
| 1 = Battery | 4 = Blade receptacle |
| 2 = Ignition/starting switch | 5 = Series resistor |
| 3 = Terminals | 6 = Ignition coil |

Danger arrows: Warning: 400 V...25 KV

2.2 Dwell angle

The dwell angle is electronically controlled.
The dwell angle is no longer measured.

2.3 Ignition timing

Is correctly indicated. Tester connections according to operating instructions.

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MOTOR-VEHICLE SERVICE INFORMATION

MOTORTESTER CONVERSION

VDT-I-Gen. 032 En

Incorrect indication of engine speed,
dwell angle and ignition point
only with trigger boxes

06.1980

0 227 100 .. (TCI-I, TCI-H) with current limitation

For additional information see

VDT-I-Gen. 030 of 06.1980

Concerns: Motortester EFAW 268

268 S 10

269

214 B

AE 2000

1. General

Please arrange for above-quoted motor-testers in your workshop as well as at your customers (e.g. motor-vehicle workshops, petroleum companies, gas stations, vocational schools etc.) to be converted. Conversion is subject to payment and is performed by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with installation of switch).

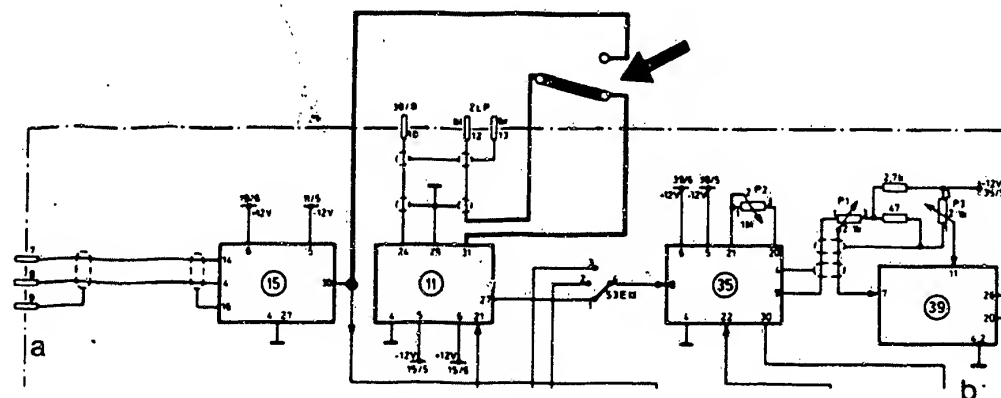
2. Why convert motortesters?

Transistorized ignition systems with current limitation have a different primary-voltage characteristic from conventional ignition systems. During the dwell period, the voltage at terminal 1 of the ignition coil may assume values between 1.5 and battery voltage (or greater), which, when checking the ignition system, may lead to an incorrect indication of engine speed and dwell angle and to incorrect triggering of the counter.

There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing strobe is triggered by the signal-path dwell-angle meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

3. Conversion measures

The situation is to be remedied by modifying the wiring of the testers so that the timing strobe is triggered by the clamp-on induction pickup and the pulse shaper stage.



227/e

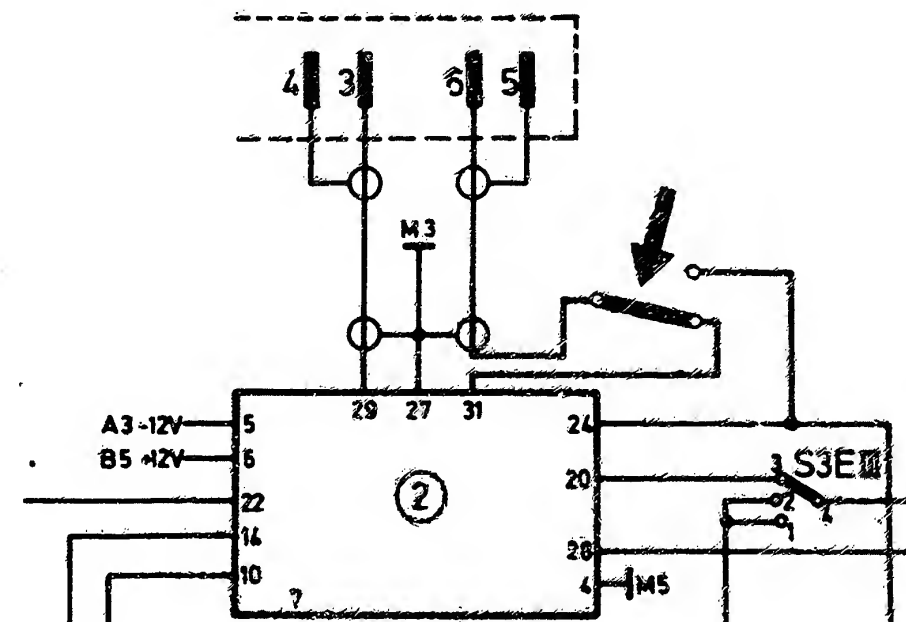
a = Clamp-on induction pickup
b = (Extract from WJF 508/1, Page 53)

EFAW 268, 268 S 10, 269, AE 2000

Remove the line of the ZLP from pin 31 of printed board 11 (coupling stage) and connect to pin 30 of printed board 15 (pulse shaper stage) via a switch with change-over contact (e.g. 0 341 500 803).

In addition, a new line must be connected from pin 31 of printed board 11 to the other contact of the switch with change-over contact.

Arrow points to switch with change-over contact.



227/f

(Extract from WJF 503/1, Page 64))

EFAW 214 B

Remove the line from terminal 6 of printed board 16 to pin 31 of printed board 2 (coupling stage) and connect to pin 24 of the same printed board via a switch with change-over contact (e.g. 0 341 500 803).

In addition, a new line must be connected from pin 31 of printed board 2 to the other contact of the switch with change-over contact.

Arrow points to switch with change-over contact.

By fitting the switch with change-over contact in the front panel of the motortester, it is possible to switch over from standard ignition systems to those with current limitation. We recommend that the switch positions be marked correspondingly:
e.g. "Standard" - "Current limitation".
These conversion measures have already been published in the K7 information sheet KJF 28/7911.

4. Test instructions

4.1 Standard ignition systems

Switch position: "Standard".

All other tester connections as per operating instructions.

4.2 Ignition systems with current limitation

Switch position: "Current limitation".

In order to trigger the timing strobe, the induction-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

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MOTOR VEHICLE SERVICE INFORMATION

TESTS ON ELECTRONIC IGNITION
SYSTEMS (TCI, TI)
TESTER INSTRUCTIONS

VDT-I-Gen. 035 En
03.1981

The following tests are listed in older and current Tester operating instructions or in "Trouble-shooting with the oscilloscope":

- * "Separate ignition coil test"
(Concerns EFAW 213, 214, 268, AE 2000)
- * Calculating the "ignition voltage reserve"
(Concerns EFAW 213, 214, 268, AE 2000 and MOT series).
- * "Intensified insulation test"
(Concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays, transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ignition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should not be carried out on transistorized ignition systems.

The contents of this Service Information has already been published in the K7 Information K7-VJF 17/8012.

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